

One Size Does Not Fit All: Interpreting Laboratory Data in Pediatric Patients

Robert S. Gillespie, MD¹, L. Clark Johnson, PhD²

¹Department of Pediatrics, University of Washington, Seattle WA, ²Department of Psychosocial and Community Health, University of Washington, Seattle WA

Abstract: Results of laboratory tests for kidney stone risk factors are reported based on adult reference ranges and are not readily interpretable in children. We have developed a solution which converts laboratory output to appropriate pediatric patient-adjusted relative units, compares results using age-specific reference ranges, and flags out-of-range values. The example presented demonstrates how clinicians with technical skills can use existing computer resources to develop effective solutions to problems they experience in clinical practice.

Kidney stones are uncommon in children, but when they do occur, a careful urinary evaluation is critical to determine the cause and appropriate treatment. This evaluation involves a panel of highly specialized diagnostic tests whose results are reported in a format intended for adult patients. Adult laboratory results are reported in absolute units, while pediatric results are only meaningful in relative units scaled to patient-specific values such as weight, body surface area or renal function. In addition, adult reports employ a single reference or “normal” range, while most pediatric tests utilize a set of age-specific reference ranges.

As a result, when these tests are done on pediatric patients, they are not interpretable until the physician has performed a series of calculations and selected appropriate reference ranges. These steps consume time and increase the possibility of human error. We are not aware of any commercial software which performs this function.

Most pediatric practices would be unlikely to find such a product cost-effective due to limited budgets and the rarity of kidney stones in children. We sought to develop a solution at a grassroots level which would make this process more efficient and reduce the possibility of errors, without incurring additional costs.

We have developed a spreadsheet template which converts laboratory output to patient-adjusted relative units appropriate for pediatric use, compares it to the appropriate age-specific reference ranges, and flags out-of-range values. The spreadsheet displays the information in color-coded numeric and graphic formats. The template is designed to be self-explanatory and requires only basic computer skills

to use. All information may be stored electronically or printed to a single 8.5x11-inch page for inclusion in patient medical records. The template is available to pediatricians at no charge, and requires only Microsoft Excel, which is already installed in many medical facilities. Alternatively, we also provide the template formatted for use with the free open-source Calc spreadsheet package from OpenOffice.org.

In a trial implementation in a group of 11 pediatric nephrologists, users reported that the spreadsheet was easy to use, saved time, and helped facilitate patient care and reduce errors.

We believe this solution would be useful to pediatricians, family physicians, urologists or any other health care providers who take care of children. In addition, the template could easily be adapted for use with many other laboratory tests in pediatric patients. These free solutions can easily be shared with a large number of potential users. This template demonstrates how clinicians can use existing computer resources to develop effective solutions to problems encountered in clinical practice, making their work more efficient and accurate.

StoneSheet-24[®] Pediatric 24-Hour Urine Analysis
Directions: Enter information in yellow fields. Under key to move to the next field.
Designed for use with 24-hour urine collections. For random (spot) specimens, the StoneSheet-24[®] is recommended.

Patient	Last Name	First Name	Date of Birth	Medical Record No.
Date	Sample	Patient	11/12/1997	123456

Height	Weight	Serum Creatinine	Sex	Pediatric?	Date of study	Age
175	65.4	0.9	Male	Yes	2/12/2001	13.3
cm	kg	mg/dl				years

Use pull-down menus

24 hour	Calcium	Creatinine	Uric Acid	Oxalate	Cystine	Citrate	Volume
Urine Collection	mg/dl	mg/dl	mg/dl	mg/dl	mg/dl	mg/dl	ml
Results	125	0.9	0.9	21	5	217	1150

Standard	Calcium	Ca/Cr	Uric Acid	Oxalate	Cystine	Citrate	Volume
Results	8.8	0.27	0.83	31	5	646	12.1
Units	mg/dl	mg/dl	mg/dl	mg/dl	mg/dl	mg/dl	ml/dl
Reference	<8.8	<0.8	<0.87	<50	<50	>600	>20

Graphic Results

Calcium, Ca/Cr, Uric Acid, Oxalate, Cystine, Citrate, Volume

Bars below dashed line are within reference range. Bars above dashed line are above reference range. Bars below dashed line are below reference range.

Calculation	Measured Creatinine Clearance	Estimated Creatinine Clearance	Body Surface Area
Results	127 ml/min/1.73 m ²	106 ml/min/1.73 m ²	1.76 m ²

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Children's
Children's Hospital and Regional Medical Center
Seattle, Washington 98105
Pediatric Urine Analysis

123456 Sample Patient 32000